

Notice of Allowability

Application No.

10/714,460

Examiner

Gordon J. Stock

Applicant(s)

SMEDT ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed November 13, 2006.
2. ☒ The allowed claim(s) is/are 1-22.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☒ Other PTOL-413B.

DETAILED ACTION

1. The Amendment received on November 13, 2006 has been entered into the record.

EXAMINER'S AMENDMENT

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Attorney Michael Stallman on December 6, 2006. **Claims 1, 6-8, 13, and 22** have been amended. Please see PTOL-413B attached.

The amended claims are as follows:

1. (Currently Amended) A method for optically inspecting and evaluating a sample fabricated with a lithography process, the method comprising:

projecting a probe beam at an overlay metrology target included in the sample,

where the overlay metrology target includes one or more gratings built into ~~[[the]]~~ an
upper layer of the sample, each of which is paired with a respective grating built into
~~[[the]]~~ a lower layer of the sample;

analyzing diffraction imparted to the probe beam by the gratings of the overlay
target to measure fine overlay between the upper and lower layers;

measuring the overlay metrology target by optical microscopy to determine the gross overlay between the upper layer and the lower layer of the sample;

generating a total overlay measurement that is consistent with both the fine and gross overlay measurements; and

using the total overlay measurement to control the lithography process.

6. (Currently Amended) A method as recited in claim 1 in which the method further comprises the steps of:

determining a range of unambiguous fine overlay measurements;

determining from the gross overlay measurement an integer count of whole fine-measurements ranges nearest to the total overlay;

forming a product by multiplying the integer count by the ~~range~~ fine-measurement range; and

adding or subtracting the fine overlay measurement to the product.

7. (Currently Amended) An overlay metrology target that comprises: one or more upper gratings formed on an upper layer of a sample, each grating having a plurality of repeating elements having a period, each paired with a respective lower grating formed on a lower layer of the sample, each grating having a total width dimension (X) and a total length dimension (Y), with at least one grating on the upper layer differing in at least one of the X or Y dimensions than its grating pair an amount sufficient to facilitate measurement of gross overlay by an optical microscope; said amount being greater than twice the period ~~be greater than two periods~~.

8. (Currently Amended) An overlay target as recited in claim 7 ~~in which~~ in which one grating is differently sized in the X dimension than its grating pair and one grating is differently sized in the Y dimension than its grating pair.

13. (Currently Amended) A method for controlling overlay of layers within semiconductor wafers created by a lithography process, the method comprising:

forming an overlay metrology target included in a sample, where the overlay metrology target includes one or more gratings built into an upper layer of the sample, each of which is paired with a respective grating built into a lower layer of the sample;

measuring the overlay metrology target to determine gross overlay between the upper layer and the lower layer of the sample;

measuring the overlay metrology target to determine fine overlay between the upper layer and the lower layer of the sample;

generating a total overlay measurement that is consistent with both the fine and gross overlay measurements; and

using the total overlay measurement to control the lithography process.

22. (Currently Amended) A method for monitoring overlay of layers in a semiconductor wafer created by a lithography process comprising the steps of:

forming an overlay metrology target included in a sample, where the overlay metrology target includes at least one pair of gratings, one grating of the pair being built

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into an upper layer of the sample and the other grating of the pair being built into a lower layer of the sample, with the grating in the upper layer differing in at least one dimension or shape from the grating in the lower layer;

measuring the overlay metrology target to determine gross overlay between the upper layer and the lower layer of the sample using optical microscopy;

measuring the overlay metrology target to determine fine overlay between the upper layer and the lower layer of the sample using a scatterometry approach;

generating a total overlay measurement that is consistent with both the fine and gross overlay measurements; and

~~using the measurement to control the lithography process~~ using the total overlay measurement to control the lithography process.

Allowable Subject Matter

3. **Claims 1-22** are allowed.

The following is an examiner's statement of reasons for allowance:

As to **claim 1**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a method for optically inspecting and evaluating a sample the particular generating a total overlay measurement step, in combination with the rest of the limitations of **claims 1-6**.

As to **claim 7**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in an overlay target "the upper layer differing in at least one of the X or Y dimensions than its grating pair an amount sufficient to facilitate measurement of gross overlay

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by an optical microscope; said amount being greater than twice the period” in combination with the rest of the limitations of **claims 7-12**.

As to **claim 13**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a method for controlling overlay within semiconductor wafers the particular generating a total overlay measurement step, in combination with the rest of the limitations of **claims 13-21**.

As to **claim 22**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a method for monitoring overlay in a semiconductor wafers the particular generating a total overlay measurement step, in combination with the rest of the limitations of **claim 22**.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

- 1) Contain either a statement “DRAFT” or “PROPOSED AMENDMENT” on the fax cover sheet; and
- 2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

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Papers related to the application may be submitted to Group 2800 by Fax transmission. Papers should be faxed to Group 2800 via the PTO Fax machine located in Crystal Plaza 4. The form of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The CP4 Fax Machine number is: (571) 273-8300

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock whose telephone number is (571) 272-2431.

The examiner can normally be reached on Monday-Friday, 10:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr., can be reached at 571-272-2800 ext 77.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private Pair system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



gs
December 6, 2006

Gregory J. Toatley, Jr.
Supervisory Patent Examiner
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